

## PATENT ABSTRACTS OF JAPAN

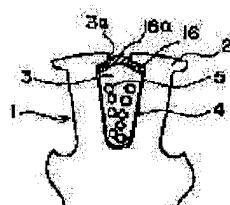
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H02K 3/34(21)Application number : **09-347874**(71)Applicant : **MITSUBISHI ELECTRIC CORP  
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OTAKA SHUICHI****(54) COMMUTATOR MOTOR****(57)Abstract:**

**PROBLEM TO BE SOLVED:** To secure the stable high-speed operation of a commutator motor by reducing mechanical loss and high-frequency noise resulting from the wind pressure, when the motor is operated at high speed.

**SOLUTION:** A commutator motor is provided with an armature core 1, a plurality of slots 2 formed among a plurality of teeth 2 on the outer periphery of the core 1, coils 5 which are respectively inserted into the slots 3, and a plurality of wedges 16 which are respectively fitted in the slots 3 for insulating the teeth 2 from coils 5. Each wedge 16 is bent in the a chevron form and fitted in each slot 3, in such a way that the projecting part of the bend is directed toward the outer peripheral side of the core 1 and faced to the narrow opening 3a of the slot near the outer periphery of the core 1.

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TITLE: Commutator motor with mechanical noise reduction function - has insulator with convex contour near teeth and projects into gap between teeth to close it

PATENT-ASSIGNEE: MITSUBISHI DENKI HOME KIKI KK [MITQ],  
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INT-CL\_ (IPC): H02K003/34; H02K003/487

ABSTRACTED-PUB-NO: JP11187601A

BASIC-ABSTRACT: NOVELTY - Armature core (1) has several slots (3) accommodating coil (5). The insulator covering the coil has convex contour (16a) near the teeth (2), closing gap between teeth.

USE - High speed commutator motor.

ADVANTAGE - As gap between teeth is closed by coil insulator, mechanical noise due to wind pressure at high speed rotation is prevented. As the convex surface of the insulator project into space between teeth tips, space factor for winding is increased. DESCRIPTION OF DRAWING(S) - The

figure shows the  
partial side view of the armature. (1) Armature core; (2)  
Teeth; (3) Slots;  
(5) Coil; (16a) Convex contour.

CHOSEN-DRAWING: Dwg.1/14

TITLE-TERMS:

COMMUTATE MOTOR MECHANICAL NOISE REDUCE FUNCTION INSULATE  
CONVEX CONTOUR TOOTH  
PROJECT GAP TOOTH CLOSE

DERWENT-CLASS: V06 X27

EPI-CODES: V06-M08; V06-M08B; V06-U01; X27-D04B;

SECONDARY-ACC-NO:

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2. \*\*\*\* shows the word which can not be translated.

3. In the drawings, any words are not translated.

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DETAILED DESCRIPTION

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[Detailed description]

[0001]

[The technical field to which invention belongs] this invention is for improving the luminous efficacy and the ambient noise of a commutator motor.

[0002]

[Prior art] Drawing 14 is the partial side elevation of the armature of the conventional commutator motor. Two or more teeth by which 1 was prepared in the armature core of a commutator motor, and 2 was prepared in the periphery of the armature core 6 in drawing, 3 is formed among two or more teeth 2, respectively, by the shape of a cross section of U characters. The slot of the plurality [ part / for opening ] of \*\*\*\* 3a, The insulating film with which 4 was prepared in the inner skin of each slot 3, the coil with which 5 was wound in the slot 3 by which the insulating film 4 was formed in inner skin, and 6 are the wedges made from paper with which it was equipped in the slot 3 wound with the coil 5. The coil 5 is useful to preventing moving out of a slot 3 with the centrifugal force at the time of rotation of the thing for which this wedge 6 maintains the insulation between the teeth 2 of the armature core 1, and the coil 5, and an armature. However, since the level difference of 2-3mm was between the periphery side of the armature core 1, and the wedge 6 by the slot number, there was a trouble where the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation and a RF region was made.

[0003] In recent years, the requests to the improvement in efficiency in the commutator motor for vacuum cleaner loading and \*\*\*\*-izing are mounting much more. Then, there is what is shown in a publication-number 211739 [ five to ] official report as technique about the wedge with which the slot of the armature core of the conventional commutator motor is equipped. Such technique was what plans the noise reduction of a RF region by using the thing which made the electric-insulation resin and the magnetic material unite with a wedge as one of the cures against an ambient noise of the motor in an armature and a stator.

[0004]

[Object of the Invention] however, in what is shown in a publication-number 211739 [ five to ] official report The structure of making a tabular electric-insulation resin and a tabular magnetic material uniting with a wedge sake, From the ability of the level difference between a core periphery side and a wedge not to be made [ when becoming disadvantageous in respect of a cost / even if it sees geometrically ] small It was what cannot solve the trouble where it becomes impossible to ignore the influence of air-resistance in the motor driven especially by high-speed rotation, and the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation and a RF region is still made.

[0005] It was made in order that this invention might cancel the above troubles, and it aims at obtaining the commutator motor which reduces the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region, and enabled it to secure stable high-speed operation.

[0006]

[The means for invention being solved] Two or more slots formed between the teeth of the plurality [ commutator motor / of the claim 1 of this invention ] of the periphery of an armature core and an armature core, It is equipped, respectively in the coil with which each of two or more slots is wound, and two or more slots. It has two or more wedges for maintaining the insulation between teeth and a coil. The aforementioned wedge is bent in the shape of [ through which a cross section passes ] a character, and is \*\*\*\*ed, and towards the orientation of a periphery of an armature core, it is arranged in a slot and becomes so that slot \*\*\*\* near the periphery of an armature core may be attended so that the projected part side of the fold may meet teeth.

[0007] The commutator motor of the claim 2 of this invention comes to have an armature core, two or more slots formed between the teeth of the plurality of the periphery of an armature core, the coil wound in two or more slots, respectively, two or more wedges for each of two or more slots being equipped and maintaining the insulation between teeth and a coil, and the insulating cylinder of the shape of a film which was excellent in wrap thermal resistance in the whole periphery side of an armature core.

[0008] Two or more slots formed between the teeth of the plurality [ commutator motor / of the claim 3 of this invention ] of the periphery of an armature core and an armature core, It is equipped, respectively in the coil with which each of two or more slots is wound, and two or more slots. It has two or more wedges for maintaining the insulation between teeth and a coil, the aforementioned wedge is fabricated in the shape of cross-section reverse T character by the heat-resistant and heat-resistant outstanding resin, and it consists of a wedge projected part which closes the wedge mainframe located in a slot, and slot

\*\*\*\*\*.

[0009] The commutator motor of the claim 4 of this invention is fabricated in the shape of cross-section reverse T character by the heat-resistant and heat-resistant outstanding resin, and the insulating ring of the outer diameter of an armature core and \*\*\*\*\* connected to two or more wedges which consist of a wedge projected part which closes the wedge mainframe located in a slot and slot \*\*\*\*\* at the end side of each of that wedge is fabricated by one.

[0010] The commutator motor of the claim 5 of this invention is fabricated in the shape of cross-section reverse T character by the heat-resistant and heat-resistant outstanding resin, and the wrap annular insulator is fabricated by one in the periphery side of the armature core connected to the wedge projected part of each of that wedge at two or more wedges which consist of a wedge projected part which closes the wedge mainframe located in a slot, and slot \*\*\*\*\*.

[0011] Two or more slots formed between the teeth of the plurality [ commutator motor / of the claim 6 of this invention ] of the periphery of an armature core and an armature core, It is equipped, respectively in the coil with which each of two or more slots is wound, and two or more slots. It has two or more wedges for maintaining the insulation between teeth and a coil. The aforementioned wedge is taken as the outstanding yarn of the thermal resistance which twisted from the flux of the coil within a slot, and was twisted until it closed a slot and slot \*\*\*\*\* and it reached the periphery side of an armature core, storing between coils.

[0012] Two or more slots formed between the teeth of the plurality [ commutator motor / of the claim 7 of this invention ] of the periphery of an armature core and an armature core, It is equipped, respectively in the coil with which each of two or more slots is wound, and two or more slots. It has two or more wedges for maintaining the insulation between teeth and a coil, and the aforementioned wedge is made to permeate into the flux of the coil within a slot, and is taken as the adhesive resin with which it filled up until it closed a slot and slot \*\*\*\*\* further and it reached the periphery side of an armature core.

[0013]

[Gestalt of implementation of invention] It is the graph with which the flank cross-section inclusion view and drawing 3 which show the status that included gestalt 1. drawing 1 of enforcement in the partial side elevation of the armature of the commutator motor of the gestalt 1 of enforcement of this invention, and drawing 2 included this armature in the commutator motor for vacuum cleaners show the side elevation of this armature, and drawing 4 shows the luminous efficacy and the ambient noise property of a commutator motor of enforcement of this invention. [ of the gestalt 1 ] Two or more teeth by which 1 was prepared in the armature core of a commutator motor, and 2 was prepared in the periphery of the armature core 6 in drawing, and 3 are formed among two or more teeth 2, respectively, and it is the cross section-like of U characters. Two or more slots which have slot \*\*\*\*\* 3a, the insulating film with which 4 was prepared in the inner skin of each slot 3, The coil with which 5 was wound in the slot 3 by which the insulating film 4 was formed in inner skin, and 9 are the wedges made from paper prepared in the core periphery [ shaft / of a commutator motor ] side within the slot 3 which was wound with the commutator of a commutator motor, and 10 and, as for 16, was wound with the coil 5.

[0014] The wedge 16 of the gestalt 1 of this enforcement is bent in the shape of [ through which a cross section passes ] a character, and it is arranged in the slot 3 towards the orientation of a periphery of the armature core 1 so that slot \*\*\*\*\* 3a near the periphery of the armature core 1 may be attended so that the projected part side of the fold 16a may meet teeth 2. Thus, the distance from the projected part side of fold 16a of the wedge 16 arranged in a slot 3 to the periphery side of the armature core 1 is set as the domain of 0-1mm.

[0015] Thus, the wedge 16 bent in the shape of [ through which a cross section passes ] a character turns in the orientation of a periphery of the armature core 1 so that the projected part side of the fold may meet teeth 2. And by being arranged in a slot 3 so that slot \*\*\*\*\* 3a near the periphery of the armature core 1 may be attended Since the distance from the projected part side of fold 16a of the wedge 16 to the periphery side of the armature core 6 is in the domain of 0-1mm and the level difference of the position of fold 16a of a wedge 16 and the periphery side of the armature core 6 becomes small, The ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation and a RF region can be reduced.

[0016] For example, as shown in the graph of drawing 4 , a motor efficiency is improvable with 50 to 51%, and according to the noise test, it is improvable [ from a certain model, ] by reducing the concavo-convex level difference of the periphery side of the armature core 1, and the wedge 16 within a slot 3 from 3.0mm to 0.3mm, from 85dB to 84dB. Moreover, since it is arranged in the slot 3 so that the projected part side of fold 16a of a wedge 16 may attend slot \*\*\*\*\* 3a near the periphery of the armature core 1, most wedges 16 will be located in slot \*\*\*\*\* 3a, the effective sectional area in which the coil 5 within a slot 3 is settled increases, and there is a machining-effect to the thing of the large specification of a space factor.

[0017] Gestalt 2. drawing 5 of enforcement is the partial side elevation of the armature of the gestalt 2 of enforcement of this invention, and drawing 6 is the perspective diagram of a wrap insulator about the wedge of this armature. In drawing, the same configuration as the gestalt 1 of enforcement of this invention omits an explanation of a configuration of having attached the same sign and having overlapped. The gestalt 2 of this enforcement is covered to the whole periphery side of the armature core 1 with the thin annular insulator 17 of the outstanding shape of a film of thermal resistance, such as polyester, a polyamidoimide, and PET (polyethylene terephthalate). It comes out. It is equipped with the same wedge 6 as the former in each slot 3.

[0018] With the gestalt 2 of this enforcement, since the whole periphery side of the armature core 1 is being worn with the thin annular insulator 17 of the outstanding shape of a heat-resistant film, the irregularity between the teeth 2 of the armature core 1 is completely lost, and the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation and a RF region can be reduced. In addition, the wedge with which it is equipped in a slot 3 cannot be overemphasized by that the wedge 16 of the gestalt 1 of enforcement of this invention is sufficient also as the same wedge 6 as the former.

[0019] Gestalt 3. drawing 7 of enforcement is the partial side elevation of the armature of the commutator motor of the gestalt 3 of enforcement of this invention, and drawing 8 is the perspective diagram of the wedge of this armature. In drawing, the same configuration as the gestalt 1 of enforcement of this invention omits an explanation of a configuration of having attached the same sign and having overlapped. The wedge 26 of the gestalt 3 of this enforcement is fabricated in the shape of cross-section reverse T character by the outstanding resin heat-resistant [ , such as PET, ] and heat-resistant, and is formed by wedge projected part 26b which closes wedge mainframe 26a and slot \*\*\*\*\* 3a which are located in a slot 3. Moreover, the superficies of wedge projected part 26b of a wedge 26 is formed in the periphery side of the armature core 1, and the same curved surface.

[0020] Thus, since the wedge mainframe 26a is located by the cross section in a slot 3 and the wedge projected part 26b has closed slot \*\*\*\*\* 3a, the level difference of the position of a wedge 26 and the periphery side of the armature core 1 of the reverse T character-like wedge 26 is lost mostly, and it can reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region. Moreover, since the superficies of wedge projected part 26b is formed in the periphery side of the armature core 1, and the same curved surface, the level difference of the position of a wedge 26 and the periphery side of the armature core 1 of it is lost completely, and it can reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region much more. Furthermore, by the heat-resistant and heat-resistant outstanding resin, the wedge 26 of the gestalt 3 of this enforcement was fabricated because it was easy to manufacture the wedge of the configuration which has the shape of complicated cross-section reverse T character.

[0021] Gestalt 4. drawing 9 of enforcement is the perspective diagram of the wedge of the armature of the gestalt 4 of enforcement of this invention. In drawing, the same configuration as the gestalt 1 of enforcement of this invention omits an explanation of a configuration of having attached the same sign and having overlapped. It comes to connect the insulating ring 27 of the outer diameter of the armature core 1, and \*\*\*\*\* with the slot 3 and end side of each wedge 26 of the gestalt 2 of enforcement of the same number with the gestalt 4 of this enforcement. The wedge 26 and the insulating ring 27 of these pluralities are fabricated by PET by one. With such gestalt 4 of enforcement, the level difference of the position of a wedge 26 and the periphery side of the armature core 1 is mostly lost like the gestalt 2 of enforcement, and the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation and a RF region can be reduced. Moreover, since the wedge 26 is formed in one, it can insert the wedge 26 of it and the same number at once to two or more slots 3, and, as for a slot 3, the wedge 26 of the same number, and the insulating ring 27, can attain simplification of a manufacture.

[0022] Gestalt 5. drawing 10 of enforcement is the partial side elevation of the armature of the gestalt 5 of enforcement of this invention, and drawing 11 is the perspective diagram of the wedge of this armature. In drawing, the same configuration as the gestalt 1 of enforcement of this invention omits an explanation of a configuration of having attached the same sign and having overlapped. The wrap annular insulator 28 comes to connect the periphery side of the armature core 1 with wedge projected part 26b of the wedge 26 of the gestalt 2 of enforcement of a slot 3 and the same number with the gestalt 5 of this enforcement. The wedge 26 and the annular insulator 28 of these pluralities are fabricated by PET by one. With such gestalt 4 of enforcement, since the periphery side of the armature core 1 is being worn with the annular insulator 47, the irregularity between the teeth 2 of the armature core 1 is completely lost like the gestalt 2 of enforcement, and the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation and a RF region can be reduced. Moreover, since two or more wedges 26 are fabricated by the annular insulator 28 and one, it is prevented that a wedge 26 moves outside with the annular insulator 28 at the time of armature high-speed rotation.

[0023] Gestalt 6. drawing 12 of enforcement is the partial side elevation of the armature of the gestalt 6 of enforcement of this invention. In drawing, the same configuration as the gestalt 1 of enforcement of this invention omits an explanation of a configuration of having attached the same sign and having overlapped. The gestalt 6 of this enforcement twists the outstanding yarn 29 of the thermal resistance of hemp, nylon, etc. from the flux of the coil 5 within a slot 3, it twists it until it closes slot \*\*\*\*\* 3a and reaches the periphery side of the armature core 1, storing between coils 3, and it constitutes a wedge.

[0024] With the gestalt 6 of this enforcement, since the outstanding yarn 29 of the thermal resistance twisted from the flux of the coil 5 within a slot 3 is twisted until it reaches the periphery side of the armature core 1, the irregularity of the periphery side of the armature core 1 of it is lost, and it can reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region. moreover -- only twisting heat-resistant outstanding yarn 29 -- since -- it is cheap

[0025] Gestalt 7. drawing 13 of enforcement is the partial side elevation of the armature of the gestalt 7 of enforcement of this invention. In drawing, the same configuration as the gestalt 1 of enforcement of this invention omits an explanation of a configuration of having attached the same sign and having overlapped. Make the adhesive resins 30, such as epoxy, permeate into the flux of the coil 5 in a slot, are filled up until it closes slot \*\*\*\*\* 3a further and it reaches the periphery side of the armature core 1, and the slot 3 and slot \*\*\*\*\* 3a are made to fix, and the gestalt 7 of this enforcement constitutes a wedge.

[0026] With the gestalt 7 of this enforcement, since it fills up until the adhesive resin 30 made to permeate into the flux of the coil 5 within a slot 3 reaches the periphery side of the armature core 1, the irregularity of the periphery side of the armature core 1 is lost, and the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation and a RF region can be reduced. Furthermore, the varnish used for fixing of the conventional coil 5 becomes unnecessary, and there is also a dominance point of keeping simultaneous the insulation between the teeth 2 and the coil 5.

[0027]

[Effect of the invention] As explained above, according to the claim 1 of this invention, bend two or more wedges with which it is equipped in two or more slots, respectively in the shape of [ through which a cross section passes ] a character, and they are \*\*\*\*\*ed. Since it is arranged in the slot towards the orientation of a periphery of an armature core so that slot \*\*\*\*\* near the periphery of an armature core may be attended so that the projected part side of the fold may meet teeth. Since the level difference of the position of the fold of each wedge and the periphery side of an armature core becomes small, it is effective in the ability to reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region. Moreover, since it is arranged in the slot so that the projected part side of the fold of a wedge may attend slot \*\*\*\*\* near the periphery of an armature core, most wedges will be located in slot \*\*\*\*\* , the effective sectional area in which the coil within a slot is settled increases, and there is a machining-effect to the thing of the large specification of a space factor.

[0028] Since the whole periphery side of an armature core is worn by the insulating cylinder of the shape of a film excellent in thermal resistance according to the claim 2 of this invention, the irregularity between the teeth of an armature core is completely lost, and it is effective in the ability to reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region.

[0029] According to the claim 3 of this invention, two or more wedges with which it is equipped in two or more slots, respectively are fabricated in the shape of cross-section reverse T character by the heat-resistant and heat-resistant outstanding resin. Since it consists of a wedge projected part which closes the wedge mainframe located in a slot, and slot \*\*\*\*\* , the position of a wedge and the level difference of the periphery side of an armature core are lost mostly, and it is effective in the ability to reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region.

[0030] According to the claim 4 of this invention, it is fabricated in the shape of cross-section reverse T character by the heat-resistant and heat-resistant outstanding resin. Since the insulating ring of the outer diameter of an armature core and \*\*\*\*\* connected to two or more wedges which consist of a wedge projected part which closes the wedge mainframe located in a slot and slot \*\*\*\*\* at the end side of each of that wedge is fabricated by one. Besides the effect that the position of a wedge and the level difference of the periphery side of an armature core can be lost mostly, and the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation and a RF region can be reduced. The wedge of it and the same number can be inserted at once to two or more slots, and it is effective in the ability to attain simplification of a manufacture.

[0031] According to the claim 5 of this invention, it is fabricated in the shape of cross-section reverse T character by the heat-resistant and heat-resistant outstanding resin. Since the wrap annular insulator is fabricated by one, the periphery side of the armature core connected to the wedge projected part of each of that wedge at two or more wedges which consist of a wedge projected part which closes the wedge mainframe located in a slot, and slot \*\*\*\*\* . The irregularity between the teeth of an armature core is completely lost, and it is effective in being prevented that a wedge moves outside with an annular insulator at the time of armature high-speed rotation other than the effect that the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation and a RF region can be reduced.

[0032] Since according to the claim 6 of this invention heat-resistant outstanding yarn was twisted from the flux of the coil within a slot, it twisted until it closed a slot and slot \*\*\*\*\* and it reached the periphery side of an armature core, storing between coils, and the wedge was constituted, the irregularity of the periphery side of an armature core is lost and it is effective in the ability to reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region. moreover, heat-resistant outstanding yarn -- twisting -- only constituting a wedge -- since -- it is effective in being cheap

[0033] Since according to the claim 7 of this invention you made it filled up until it made the adhesive resin permeate into the flux of the coil within a slot, it closed a slot and slot \*\*\*\*\* further and it reached the periphery side of an armature core, and the wedge was constituted, the irregularity of the periphery side of an armature core is lost and it is effective in the ability to reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region. Moreover, since a wedge is constituted from an adhesive resin, the varnish used for fixing of the conventional coil becomes unnecessary, and it is effective in keeping the insulation between teeth and a coil simultaneous.

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[Translation done.]

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## EFFECT OF THE INVENTION

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[Effect of the invention] As explained above, according to the claim 1 of this invention, bend two or more wedges with which it is equipped in two or more slots, respectively in the shape of [ through which a cross section passes ] a character, and they are \*\*\*\*\*ed. Since it is arranged in the slot towards the orientation of a periphery of an armature core so that slot \*\*\*\*\* near the periphery of an armature core may be attended so that the projected part side of the fold may meet teeth. Since the level difference of the position of the fold of each wedge and the periphery side of an armature core becomes small, it is effective in the ability to reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region. Moreover, since it is arranged in the slot so that the projected part side of the fold of a wedge may attend slot \*\*\*\*\* near the periphery of an armature core, most wedges will be located in slot \*\*\*\*\*, the effective sectional area in which the coil within a slot is settled increases, and there is a machining-effect to the thing of the large specification of a space factor.

[0028] Since the whole periphery side of an armature core is worn by the insulating cylinder of the shape of a film excellent in thermal resistance according to the claim 2 of this invention, the irregularity between the teeth of an armature core is completely lost, and it is effective in the ability to reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region.

[0029] According to the claim 3 of this invention, two or more wedges with which it is equipped in two or more slots, respectively are fabricated in the shape of cross-section reverse T character by the heat-resistant and heat-resistant outstanding resin. Since it consists of a wedge projected part which closes the wedge mainframe located in a slot, and slot \*\*\*\*\*, the position of a wedge and the level difference of the periphery side of an armature core are lost mostly, and it is effective in the ability to reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region.

[0030] According to the claim 4 of this invention, it is fabricated in the shape of cross-section reverse T character by the heat-resistant and heat-resistant outstanding resin. Since the insulating ring of the outer diameter of an armature core and \*\*\*\*\* connected to two or more wedges which consist of a wedge projected part which closes the wedge mainframe located in a slot and slot \*\*\*\*\* at the end side of each of that wedge is fabricated by one. Besides the effect that the position of a wedge and the level difference of the periphery side of an armature core can be lost mostly, and the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation and a RF region can be reduced. The wedge of it and the same number can be inserted at once to two or more slots, and it is effective in the ability to attain simplification of a manufacture.

[0031] According to the claim 5 of this invention, it is fabricated in the shape of cross-section reverse T character by the heat-resistant and heat-resistant outstanding resin. Since the wrap annular insulator is fabricated by one, the periphery side of the armature core connected to the wedge projected part of each of that wedge at two or more wedges which consist of a wedge projected part which closes the wedge mainframe located in a slot, and slot \*\*\*\*\*. The irregularity between the teeth of an armature core is completely lost, and it is effective in being prevented that a wedge moves outside with an annular insulator at the time of armature high-speed rotation other than the effect that the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation and a RF region can be reduced.

[0032] Since according to the claim 6 of this invention heat-resistant outstanding yarn was twisted from the flux of the coil within a slot, it twisted until it closed a slot and slot \*\*\*\*\* and it reached the periphery side of an armature core, storing between coils, and the wedge was constituted, the irregularity of the periphery side of an armature core is lost and it is effective in the ability to reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region. moreover, heat-resistant outstanding yarn -- twisting -- only constituting a wedge -- since -- it is effective in being cheap

[0033] Since according to the claim 7 of this invention you made it filled up until it made the adhesive resin permeate into the flux of the coil within a slot, it closed a slot and slot \*\*\*\*\* further and it reached the periphery side of an armature core, and the wedge was constituted, the irregularity of the periphery side of an armature core is lost and it is effective in the ability to reduce the ambient noise of the mechanical loss by the wind pressure at the time of high-speed rotation, and a RF region. Moreover, since a wedge is constituted from an adhesive resin, the varnish used for fixing of the conventional coil becomes unnecessary, and it is effective in keeping the insulation between teeth and a coil simultaneous.

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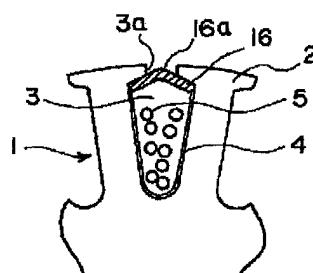
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(54)【発明の名称】 整流子電動機

(57)【要約】

【課題】 高速回転時の風圧による機械的損失及び高周波域の騒音を低減し、安定した高速運転が確保できるようすること。

【解決手段】 電機子コア1と、電機子コアの外周の複数のティース2間に形成された複数のスロット3と、複数のスロットのそれぞれに巻装されるコイル5と、複数のスロット内にそれぞれ装着され、ティース及びコイル間の絶縁を維持するための複数のウェッジ16とを備え、ウェッジ16は断面がへの字状に折り曲げて形成され、その折り目16aの突部側がティースに沿うよう電機子コアの外周方向に向け、且つ電機子コアの外周付近のスロット狭開口3aに臨むようにスロット内に配置されてなるものである。



1 : 電機子コア

2 : ティース

3 : スロット

5 : コイル

16 : ウェッジ

16a : 折り目

## 【特許請求の範囲】

【請求項1】 電機子コアと、電機子コアの外周の複数のティース間に形成された複数のスロットと、複数のスロットのそれぞれに巻装されるコイルと、複数のスロット内にそれぞれ装着され、ティース及びコイル間の絶縁を維持するための複数のウェッジとを備え、前記ウェッジは断面がへの字状に折り曲げて形成され、その折り目の突部側がティースに沿うよう電機子コアの外周方向に向け、且つ電機子コアの外周付近のスロット狭開口に臨むようにスロット内に配置されたことを特徴とする整流子電動機。

【請求項2】 電機子コアと、電機子コアの外周の複数のティース間に形成された複数のスロットと、複数のスロット内にそれぞれ巻装されるコイルと、複数のスロットのそれぞれに装着され、ティース及びコイル間の絶縁を維持するための複数のウェッジと、電機子コアの外周面全体を覆う耐熱性に優れたフィルム状の絶縁筒とを備えたことを特徴とする整流子電動機。

【請求項3】 電機子コアと、電機子コアの外周の複数のティース間に形成された複数のスロットと、複数のスロットのそれぞれに巻装されるコイルと、複数のスロット内にそれぞれ装着され、ティース及びコイル間の絶縁を維持するための複数のウェッジとを備え、前記ウェッジは耐熱性及び耐熱性の優れた樹脂で断面逆T字状に成形され、スロット内に位置するウェッジ本体とスロット狭開口を塞ぐウェッジ突部とからなることを特徴とする整流子電動機。

【請求項4】 前記複数のウェッジにその各ウェッジの一端側に接続される電機子コアの外径と略同径の絶縁輪が一体に成形されていることを特徴とする請求項3記載の整流子電動機。

【請求項5】 前記複数のウェッジにその各ウェッジのウェッジ突部に接続される電機子コアの外周面を覆う環状絶縁体が一体に成形されていることを特徴とする請求項3記載の整流子電動機。

【請求項6】 電機子コアと、電機子コアの外周の複数のティース間に形成された複数のスロットと、複数のスロットのそれぞれに巻装されるコイルと、複数のスロット内にそれぞれ装着され、ティース及びコイル間の絶縁を維持するための複数のウェッジとを備え、前記ウェッジはスロット内におけるコイルの東の上から巻き付け、コイル間に収めながらスロット及びスロット狭開口を塞いで電機子コアの外周面に至るまで巻き付けた耐熱性の優れた糸であることを特徴とする整流子電動機。

【請求項7】 電機子コアと、電機子コアの外周の複数のティース間に形成された複数のスロットと、複数のスロットのそれぞれに巻装されるコイルと、複数のスロット内にそれぞれ装着され、ティース及びコイル間の絶縁を維持するための複数のウェッジとを備え、

前記ウェッジはスロット内におけるコイルの東中に浸透させ、さらにスロット及びスロット狭開口を塞いで電機子コアの外周面に至るまで充填された接着性樹脂であることを特徴とする整流子電動機。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は整流子電動機の効率及び騒音を改善するためのものである。

## 【0002】

10 【従来の技術】図14は従来の整流子電動機の電機子の部分側面図である。図において、1は整流子電動機の電機子コア、2は電機子コア6の外周に設けられた複数のティース、3は複数のティース2間にそれぞれ形成され、断面U字状で開口部分が挿口3aの複数のスロット、4は各スロット3の内周面に設けられた絶縁フィルム、5は内周面に絶縁フィルム4が設けられたスロット3内に巻装されたコイルと、6はコイル5が巻装されたスロット3内に装着された紙製のウェッジである。このウェッジ6は電機子コア1のティース2及びコイル5間の絶縁を維持すること及び電機子の回転時における遠心力によりコイル5がスロット3外に動くのを防止するのに役立っている。しかし、電機子コア1の外周面とウェッジ6との間に2~3mmの段差がスロット個数分あるため、高速回転時の風圧による機械的損失及び高周波域の騒音が生じるという問題点があった。

20 【0003】近年、電気掃除機搭載用整流子電動機における効率改善及び静音化への要望は一層高まっている。そこで、従来の整流子電動機の電機子コアのスロットに装着されるウェッジに関する技術として特開平5-211739号公報に示されるものがある。かかる技術は、電機子及び固定子における電動機の騒音対策のひとつとして、ウェッジに電気絶縁性樹脂及び磁性材料を一体化させたものを用いることにより、高周波域の騒音低減を図るものであった。

## 【0004】

【発明が解決しようとする課題】しかしながら、特開平5-211739号公報に示されるものでは、ウェッジに板状の電気絶縁性樹脂と板状の磁性材料を一体化させる構造のため、コスト面で不利となる上、形状的にみてもコア外周面及びウェッジ間の段差を小さくすることができないことから、特に高速回転で駆動する電動機においては空気的抵抗の影響が無視できなくなり、依然高速回転時の風圧による機械的損失及び高周波域の騒音が生じるという問題点を解決することはできないものであった。

40 【0005】本発明は上記のような問題点を解消するためになされたもので、高速回転時の風圧による機械的損失及び高周波域の騒音を低減し、安定した高速運転が確保できるようにした整流子電動機を得ることを目的とする。

## 【0006】

【発明が解決するための手段】本発明の請求項1の整流子電動機は、電機子コアと、電機子コアの外周の複数のティース間に形成された複数のスロットと、複数のスロットのそれぞれに巻装されるコイルと、複数のスロット内にそれぞれ装着され、ティース及びコイル間の絶縁を維持するための複数のウェッジとを備え、前記ウェッジは断面がへの字状に折り曲げて形成され、その折り目の突部側がティースに沿うよう電機子コアの外周方向に向け、且つ電機子コアの外周付近のスロット狭開口に臨むようにスロット内に配置されてなるものである。

【0007】本発明の請求項2の整流子電動機は、電機子コアと、電機子コアの外周の複数のティース間に形成された複数のスロットと、複数のスロット内にそれぞれ巻装されるコイルと、複数のスロットのそれぞれに装着され、ティース及びコイル間の絶縁を維持するための複数のウェッジと、電機子コアの外周面全体を覆う耐熱性に優れたフィルム状の絶縁筒とを備えてなるものである。

【0008】本発明の請求項3の整流子電動機は、電機子コアと、電機子コアの外周の複数のティース間に形成された複数のスロットと、複数のスロットのそれぞれに巻装されるコイルと、複数のスロット内にそれぞれ装着され、ティース及びコイル間の絶縁を維持するための複数のウェッジとを備え、前記ウェッジは耐熱性及び耐熱性の優れた樹脂で断面逆T字状に成形され、スロット内に位置するウェッジ本体とスロット狭開口を塞ぐウェッジ突部とからなるものである。

【0009】本発明の請求項4の整流子電動機は、耐熱性及び耐熱性の優れた樹脂で断面逆T字状に成形され、スロット内に位置するウェッジ本体とスロット狭開口を塞ぐウェッジ突部とからなる複数のウェッジに、その各ウェッジの一端側に接続される電機子コアの外径と略同径の絶縁輪が一体に成形されているものである。

【0010】本発明の請求項5の整流子電動機は、耐熱性及び耐熱性の優れた樹脂で断面逆T字状に成形され、スロット内に位置するウェッジ本体とスロット狭開口を塞ぐウェッジ突部とからなる複数のウェッジに、その各ウェッジのウェッジ突部に接続される電機子コアの外周面を覆う環状絶縁体が一体に成形されているものである。

【0011】本発明の請求項6の整流子電動機は、電機子コアと、電機子コアの外周の複数のティース間に形成された複数のスロットと、複数のスロットのそれぞれに巻装されるコイルと、複数のスロット内にそれぞれ装着され、ティース及びコイル間の絶縁を維持するための複数のウェッジとを備え、前記ウェッジはスロット内におけるコイルの束の上から巻き付け、コイル間に収めながらスロット及びスロット狭開口を塞いで電機子コアの外周面に至るまで巻き付けた耐熱性の優れた糸としたもの

である。

【0012】本発明の請求項7の整流子電動機は、電機子コアと、電機子コアの外周の複数のティース間に形成された複数のスロットと、複数のスロットのそれぞれに巻装されるコイルと、複数のスロット内にそれぞれ装着され、ティース及びコイル間の絶縁を維持するための複数のウェッジとを備え、前記ウェッジはスロット内におけるコイルの束中に浸透させ、さらにスロット及びスロット狭開口を塞いで電機子コアの外周面に至るまで充填された接着性樹脂としたものである。

## 【0013】

【発明の実施の形態】実施の形態1. 図1は本発明の実施の形態1の整流子電動機の電機子の部分側面図、図2は同電機子を電気掃除機用整流子電動機に組み込んだ状態を示す側部断面組込図、図3は同電機子の側面図、図4は本発明の実施の形態1の整流子電動機の効率及び騒音特性を示すグラフである。図において、1は整流子電動機の電機子コア、2は電機子コア6の外周に設けられた複数のティース、3は複数のティース2間にそれぞれ形成され、断面U字状で、スロット狭開口3aを有する複数のスロット、4は各スロット3の内周面に設けられた絶縁フィルム、5は内周面に絶縁フィルム4が設けられたスロット3内に巻装されたコイル、9は整流子電動機の整流子、10は整流子電動機の軸、16はコイル5が巻装されたスロット3内のコア外周側に設けられた紙製のウェッジである。

【0014】この実施の形態1のウェッジ16は、断面がへの字状に折り曲げられ、その折り目16aの突部側がティース2に沿うよう電機子コア1の外周方向に向け、且つ電機子コア1の外周付近のスロット狭開口3aに臨むようにスロット3内に配置されている。このようにスロット3内に配置されたウェッジ16の折り目16aの突部側から電機子コア1の外周面までの距離は0~1mmの範囲に設定されている。

【0015】このように断面がへの字状に折り曲げられたウェッジ16が、その折り目の突部側がティース2に沿うよう電機子コア1の外周方向に向け、且つ電機子コア1の外周付近のスロット狭開口3aに臨むようにスロット3内に配置されることにより、そのウェッジ16の折り目16aの突部側から電機子コア6の外周面までの距離は0~1mmの範囲にあり、ウェッジ16の折り目16aの位置と電機子コア6の外周面との段差が小さくなるため、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができる。

【0016】例えば図4のグラフに示すように、電機子コア1の外周面とスロット3内のウェッジ16との凹凸段差を3.0mmから0.3mmに減らすことと、ある機種ではモータ効率を50%から51%と改善することができ、また騒音試験によれば85dBから84dBに改善することができる。また、ウェッジ16の折り目1

6aの突部側が電機子コア1の外周付近のスロット狭開口3aに臨むようにスロット3内に配置されているので、ウェッジ16の大部分がスロット狭開口3aに位置することとなり、スロット3内におけるコイル5の収まる有効断面積が増大し、占積率の大きい仕様のものに対して工作的な効果がある。

【0017】実施の形態2. 図5は本発明の実施の形態2の電機子の部分側面図、図6は同電機子のウェッジを覆う絶縁体の斜視図である。図において、本発明の実施の形態1と同様の構成は同一符号を付して重複した構成の説明を省略する。この実施の形態2は、電機子コア1の外周面全体に例えばポリエステル、ポリアミドイミド、PET(ポリエチレンテレフタレート)等の耐熱性の優れたフィルム状の薄い環状絶縁体17で覆うようにしたものである。である。各スロット3内には従来と同様なウェッジ6が装着されている。

【0018】この実施の形態2では、電機子コア1の外周面全体が耐熱性の優れたフィルム状の薄い環状絶縁体17で覆われているから、電機子コア1のティース2間の凹凸が全く無くなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができる。なお、スロット3内に装着されるウェッジは従来と同様なウェッジ6でも、本発明の実施の形態1のウェッジ16でもよいことはいうまでもない。

【0019】実施の形態3. 図7は本発明の実施の形態3の整流子電動機の電機子の部分側面図、図8は同電機子のウェッジの斜視図である。図において、本発明の実施の形態1と同様の構成は同一符号を付して重複した構成の説明を省略する。この実施の形態3のウェッジ26は、例えばPET等の耐熱性及び耐熱性の優れた樹脂で断面逆T字状に成形され、スロット3内に位置するウェッジ本体26aとスロット狭開口3aを塞ぐウェッジ突部26bとで形成されている。また、ウェッジ26のウェッジ突部26bの外面は電機子コア1の外周面と同様の曲面に形成されている。

【0020】このように断面が逆T字状のウェッジ26は、そのウェッジ本体26aがスロット3内に位置し、そのウェッジ突部26bがスロット狭開口3aを塞いでいるから、ウェッジ26の位置と電機子コア1の外周面との段差がほぼ無くなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができる。また、ウェッジ突部26bの外面は電機子コア1の外周面と同様の曲面に形成されているから、ウェッジ26の位置と電機子コア1の外周面との段差が完全になくなり、より一層高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができる。さらに、この実施の形態3のウェッジ26を耐熱性及び耐熱性の優れた樹脂で成形したのは、複雑な断面逆T字状である形状のウェッジを製作し易いからである。

【0021】実施の形態4. 図9は本発明の実施の形態

4の電機子のウェッジの斜視図である。図において、本発明の実施の形態1と同様の構成は同一符号を付して重複した構成の説明を省略する。この実施の形態4では、スロット3と同数の実施の形態2の各ウェッジ26の一端側に電機子コア1の外径と略同径の絶縁輪27が接続されてなる。これら複数のウェッジ26と絶縁輪27とはPETで一体に成形されている。このような実施の形態4では、実施の形態2と同様にウェッジ26の位置と電機子コア1の外周面との段差がほぼ無くなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができる。また、ウェッジ26は、スロット3と同数のウェッジ26と絶縁輪27とは一体に形成されているから、複数のスロット3に対してそれと同数のウェッジ26を一度に挿入でき、製作の簡略化を図ることが出来る。

【0022】実施の形態5. 図10は本発明の実施の形態5の電機子の部分側面図、図11は同電機子のウェッジの斜視図である。図において、本発明の実施の形態1と同様の構成は同一符号を付して重複した構成の説明を省略する。この実施の形態5では、スロット3と同数の実施の形態2のウェッジ26のウェッジ突部26bに電機子コア1の外周面を覆う環状絶縁体28が接続される。これら複数のウェッジ26と環状絶縁体28とはPETで一体に成形されている。このような実施の形態4では、電機子コア1の外周面が環状絶縁体47で覆われているから、実施の形態2と同様に電機子コア1のティース2間の凹凸が全く無くなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができる。また、複数のウェッジ26が環状絶縁体28と一緒に形成されているから、環状絶縁体28によりウェッジ26が電機子高速回転時に外に移動するのが防止される。

【0023】実施の形態6. 図12は本発明の実施の形態6の電機子の部分側面図である。図において、本発明の実施の形態1と同様の構成は同一符号を付して重複した構成の説明を省略する。この実施の形態6は、例えば麻、ナイロン等の耐熱性の優れた糸29をスロット3内におけるコイル5の束の上から巻き付け、コイル3間に収めながらスロット狭開口3aを塞いで電機子コア1の外周面に至るまで巻き付けてウェッジを構成したものである。

【0024】この実施の形態6では、スロット3内におけるコイル5の束の上から巻き付けられた耐熱性の優れた糸29は電機子コア1の外周面に至るまで巻き付けられるから、電機子コア1の外周面の凹凸がなくなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができる。また、耐熱性の優れた糸29を巻き付けるだけであるから、安価である。

【0025】実施の形態7. 図13は本発明の実施の形態7の電機子の部分側面図である。図において、本発明

の実施の形態1と同様の構成は同一符号を付して重複した構成の説明を省略する。この実施の形態7は、例えばエポキシなどの接着性樹脂30をスロットにおけるコイル5の束中に浸透させ、さらにスロット狭開口3aを塞いで電機子コア1の外周面に至るまで充填し、スロット3及びスロット狭開口3aに固定させてウェッジを構成したものである。

【0026】この実施の形態7では、スロット3内におけるコイル5の束中に浸透させた接着性樹脂30は電機子コア1の外周面に至るまで充填されているから、電機子コア1の外周面の凹凸がなくなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができる。さらに、従来のコイル5の固定のために用いていたワニスが不要となり、同時にティース2及びコイル5間の絶縁を保つという優位点もある。

#### 【0027】

【発明の効果】以上説明したように、本発明の請求項1によれば、複数のスロット内にそれぞれ装着される複数のウェッジは断面がへの字状に折り曲げて形成され、その折り目の突部側がティースに沿うよう電機子コアの外周方向に向け、且つ電機子コアの外周付近のスロット狭開口に臨むようにスロット内に配置されているので、各ウェッジの折り目の位置と電機子コアの外周面との段差が小さくなるため、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができるという効果がある。また、ウェッジの折り目の突部側が電機子コアの外周付近のスロット狭開口に臨むようにスロット内に配置されているので、ウェッジの大部分がスロット狭開口に位置することとなり、スロット内におけるコイルの収まる有効断面積が増大し、占積率の大きい仕様のものに対して工作的な効果がある。

【0028】本発明の請求項2によれば、電機子コアの外周面全体を耐熱性に優れたフィルム状の絶縁筒で覆っているので、電機子コアのティース間の凹凸が全く無くなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができるという効果がある。

【0029】本発明の請求項3によれば、複数のスロット内にそれぞれ装着される複数のウェッジは耐熱性及び耐熱性の優れた樹脂で断面逆T字状に形成され、スロット内に位置するウェッジ本体とスロット狭開口を塞ぐウェッジ突部とからなるので、ウェッジの位置と電機子コアの外周面の段差がほぼ無くなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができるという効果がある。

【0030】本発明の請求項4によれば、耐熱性及び耐熱性の優れた樹脂で断面逆T字状に形成され、スロット内に位置するウェッジ本体とスロット狭開口を塞ぐウェッジ突部とからなる複数のウェッジに、その各ウェッジの一端側に接続される電機子コアの外径と略同径の絶縁輪が一体に形成されているので、ウェッジの位置と電機

子コアの外周面の段差がほぼ無くなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができるという効果の他に、複数のスロットに対してそれと同数のウェッジを一度に挿入でき、製作の簡略化を図ることができるという効果がある。

【0031】本発明の請求項5によれば、耐熱性及び耐熱性の優れた樹脂で断面逆T字状に形成され、スロット内に位置するウェッジ本体とスロット狭開口を塞ぐウェッジ突部とからなる複数のウェッジに、その各ウェッジのウェッジ突部に接続される電機子コアの外周面を覆う環状絶縁体が一体に形成されているので、電機子コアのティース間の凹凸が全く無くなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができるという効果の他に、環状絶縁体によってウェッジが電機子高速回転時に外に移動するのが防止されるという効果もある。

【0032】本発明の請求項6によれば、耐熱性の優れた糸をスロット内におけるコイルの束の上から巻き付け、コイル間に収めながらスロット及びスロット狭開口を塞いで電機子コアの外周面に至るまで巻き付けてウェッジを構成したので、電機子コアの外周面の凹凸がなくなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができるという効果がある。また、耐熱性の優れた糸を巻き付けてウェッジを構成するだけであるから、安価であるという効果もある。

【0033】本発明の請求項7によれば、接着性樹脂をスロット内におけるコイルの束中に浸透させ、さらにスロット及びスロット狭開口を塞いで電機子コアの外周面に至るまで充填させてウェッジを構成したので、電機子コアの外周面の凹凸がなくなり、高速回転時の風圧による機械的損失及び高周波域の騒音を低減することができるという効果がある。また、接着性樹脂でウェッジを構成するので、従来のコイルの固定のために用いていたワニスが不要となり、同時にティース及びコイル間の絶縁を保つという効果もある。

#### 【図面の簡単な説明】

【図1】 本発明の実施の形態1の整流子電動機の電機子の部分側面図である。

【図2】 同電機子を電気掃除機用整流子電動機に組み込んだ状態を示す側部断面組込図である。

【図3】 同電機子の側面図である。

【図4】 本発明の実施の形態1の整流子電動機の効率及び騒音特性を示すグラフである。

【図5】 本発明の実施の形態2の電機子の部分側面図である。

【図6】 同電機子のウェッジを覆う絶縁体の斜視図である。

【図7】 本発明の実施の形態3の整流子電動機の電機子の部分側面図である。

【図8】 同電機子のウェッジの斜視図である。

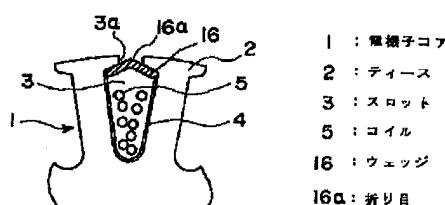
【図9】 本発明の実施の形態4の電機子のウェッジの斜視図である。

【図10】 本発明の実施の形態5の電機子の部分側面図である。

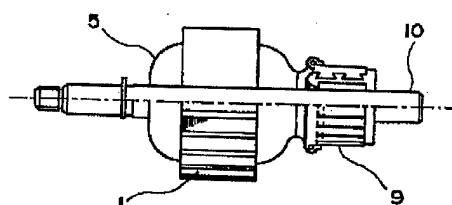
【図11】 同電機子のウェッジの斜視図である。

【図12】 本発明の実施の形態6の電機子の部分側面図である。

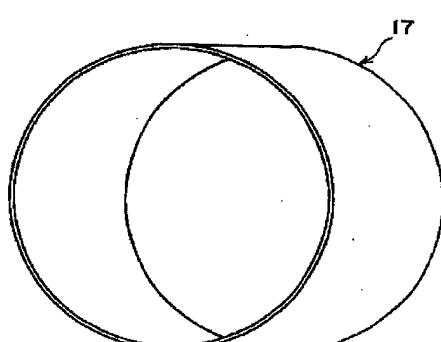
【図1】



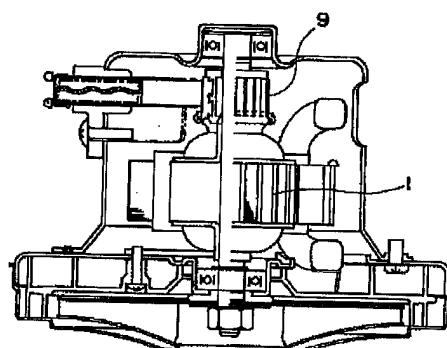
【図3】



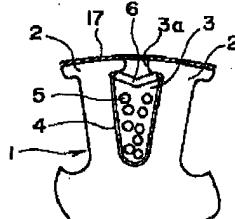
【図6】



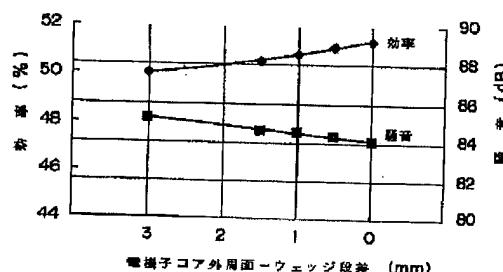
【図2】



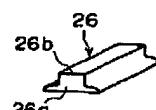
【図5】



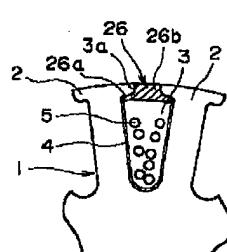
【図4】



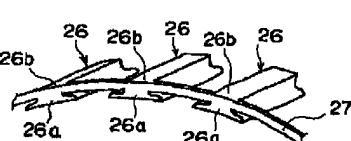
【図8】



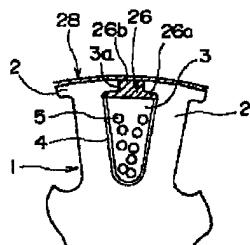
【図7】



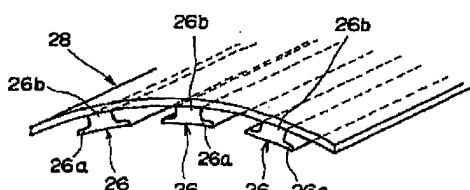
【図9】



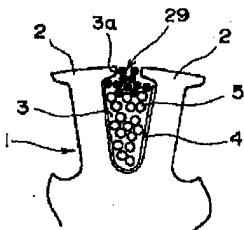
【図10】



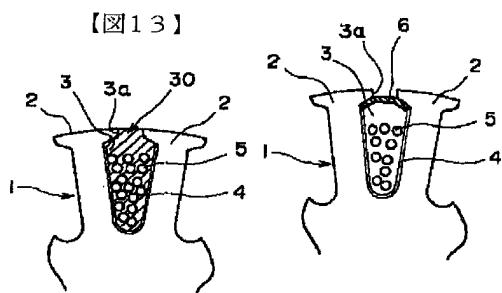
【図11】



【図12】



【図14】



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